

CLAIMS

1. A membrane electrode assembly comprising a hydrogen ion conductive polymer electrolyte membrane, a pair of catalyst layers arranged on both surfaces of said polymer electrolyte membrane, and a pair of gas diffusion layers, each comprising a fibrous substrate, arranged on the outer surfaces of said catalyst layers, characterized in that,

in said fibrous substrate, a thickness T_A of a center portion that faces said catalyst layer and a thickness T_B of a peripheral portion surrounding said center portion have a relation represented by the following expression (1):

$$0.7 \leq T_B/T_A \leq 0.9 \quad \cdots (1).$$

2. The membrane electrode assembly in accordance with claim 1, characterized in that,

in said fibrous substrate, a thread diameter D_A of said center portion and a thread diameter D_B of said peripheral portion have a relation represented by the following expression (2):

$$D_B < D_A \quad \cdots (2).$$

3. The membrane electrode assembly in accordance with claim 1, characterized in that,

in said fibrous substrate, a warp and weft thread count N_B per unit area of said peripheral portion and a warp and weft thread count N_A per unit area of said center portion have a relation represented by the following expression (3):

$$N_B < N_A \cdots (3).$$

4. The membrane electrode assembly in accordance with claim 1, characterized in that,
in said fibrous substrate, said peripheral portion is pressed.

5. The membrane electrode assembly in accordance with any one of claims 1 to 4, characterized in that,
said fibrous substrate comprises a water repellent,
and

a water repellent concentration H_B of said peripheral portion and a water repellent concentration H_A of said center portion have a relation represented by the following expression (4):

$$H_B > H_A \cdots (4).$$

6. The membrane electrode assembly in accordance with any one of claims 1 to 5, characterized in that,
a variation of the thickness T_A of said peripheral portion is not greater than 10 μm .

7. The membrane electrode assembly in accordance with any one of claims 1 to 6, characterized in that,
said gas diffusion layer has a water repellent carbon layer on a main surface of said fibrous substrate at the catalyst layer side.

8. A polymer electrolyte fuel cell comprising the membrane electrode assembly in accordance with claim 1, and a pair of conductive separators, each having a gas flow channel,

arranged on both surfaces of said membrane electrode assembly.

9. A method for producing a membrane electrode assembly comprising a hydrogen ion conductive polymer electrolyte membrane, a pair of catalyst layers arranged on both surfaces of said polymer electrolyte membrane, and a pair of gas diffusion layers, each comprising a fibrous substrate, arranged on the outer surfaces of said catalyst layers,

said method comprising a step of producing said fibrous substrate such that a thickness T_A of a center portion that faces said catalyst layer and a thickness T_B of a peripheral portion surrounding said center portion have a relation represented by the following expression (1), and that a thread diameter D_A of said center portion and a thread diameter D_B of said peripheral portion have a relation represented by the following expression (2):

$$0.7 \leq T_B/T_A \leq 0.9 \quad \cdots (1),$$

$$D_B < D_A \quad \cdots (2).$$

10. A method for producing a membrane electrode assembly comprising a hydrogen ion conductive polymer electrolyte membrane, a pair of catalyst layers arranged on both surfaces of said polymer electrolyte membrane, and a pair of gas diffusion layers, each comprising a fibrous substrate, arranged on the outer surfaces of said catalyst layers,

said method comprising a step of producing said fibrous substrate such that a thickness T_A of a center portion that faces said catalyst layer and a thickness T_B of a

peripheral portion surrounding said center portion have a relation represented by the following expression (1), and a warp and weft thread count N_B per unit area of said peripheral portion and a warp and weft thread count N_A per unit area of said center portion have a relation represented by the following expression (3):

$$0.7 \leq T_B/T_A \leq 0.9 \quad \cdots (1),$$

$$N_B < N_A \quad \cdots (3).$$

11. A method for producing a membrane electrode assembly comprising a hydrogen ion conductive polymer electrolyte membrane, a pair of catalyst layers arranged on both surfaces of said polymer electrolyte membrane, and a pair of gas diffusion layers, each comprising a fibrous substrate, arranged on the outer surfaces of said catalyst layers,

said method comprising a step of producing said fibrous substrate, by pressing said peripheral portion, such that a thickness T_A of a center portion that faces said catalyst layer and a thickness T_B of a peripheral portion surrounding said center portion have a relation represented by the following expression (1):

$$0.7 \leq T_B/T_A \leq 0.9 \quad \cdots (1).$$

12. A method for producing a membrane electrode assembly comprising a hydrogen ion conductive polymer electrolyte membrane, a pair of catalyst layers arranged on both surfaces of said polymer electrolyte membrane, and a pair of gas diffusion layers, each comprising a fibrous substrate,

arranged on the outer surfaces of said catalyst layers,

said method comprising a step of producing said fibrous substrate comprising a water repellent such that a thickness T_A of a center portion that faces said catalyst layer and a thickness T_B of a peripheral portion surrounding said center portion have a relation represented by the following expression (1), and that a water repellent concentration H_B of said peripheral portion and a water repellent concentration H_A of said center portion have a relation represented by the following expression (4):

$$0.7 \leq T_B/T_A \leq 0.9 \quad \cdots (1),$$

$$H_B > H_A \quad \cdots (4).$$